Bankruptcy Probability:
A Theoretical and Empirical Examination

A thesis presented

by

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to

The School of Finance and Economics

in fulfillment of the requirements
for the degree of

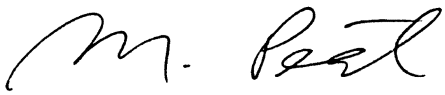
Doctor of Philosophy

University of Technology, Sydney
2001

Certificate

I certify that this thesis has not already been submitted for any degree and is not being submitted as part of candidature for any other degree.

I also certify that the thesis has been written by me and that any help that I have received in preparing this thesis, and all sources used, have been acknowledged in this thesis.



Acknowledgments

Thanks to Max Stevenson my long suffering Supervisor.

Especial thanks to Cheryl, Alexandra and Liam for the support they have and continue to offer me in my endeavors.

Contents

List of Tables

List of Figures

Abstract

Early Bankruptcy classification models were developed to demonstrate the usefulness of information contained in financial statements. The majority of classification models developed have used a pool of financial ratios combined with statistical variable selection techniques to maximise the accuracy of the classifier being employed. Rather than follow an "ad hoc" variable selection process, this thesis seeks to provide an economic basis for the selection of variables for inclusion in bankruptcy models, which are based on accounting information. An implicit assumption underlying this work is that the probability of default is endogenous. That is, the decisions of a firm's management have a direct impact on the probability of bankruptcy. These decisions and their resultant effects can be identified through analysis of financial statements.

A model of a firm facing an uncertain environment with the possibility of bankruptcy is developed and analysed. In the model, a firm is created with given initial equity. These funds can be invested in productive resources or held as cash balances. The productive resources are used to earn random earnings in any period. If earnings are positive, they can be used to pay dividends to shareholders, invest in new productive resources, repay outstanding debt or increase the firm's cash balance. The firm is able to borrow and repay funds up to a credit limit. When the cash position of the firm falls to zero the firm is bankrupt. The firm attempts to maximise the stream of dividends paid to shareholders during its life. The solutions of the model and the associated bankruptcy probability expressions are derived by application of the dynamic programming algorithm.

The variables which differentiate the possible model solutions and those identified in the derived bankruptcy probability expressions, are 'proxied' by variables constructed from financial statement data. This data is derived from Annual Reports filed with the Australian Stock Exchange between 1966 and 1994. These proxy variables are used in the empirical validation of bankruptcy probability expressions derived from the model.

The random nature of the time horizon in the model for a single firm provides the rationale for the use of duration or hazard-based statistical methods in the validation of the derived bankruptcy probability expressions. The Cox (1972) proportional hazards model is used to estimate the coefficients and standard errors that are required for the validation of the derived bankruptcy probability expressions.

Results of the validation exercise confirm that the variables included in the empirical hazard formulation behave in a way that is consistent with the solutions of the model of the firm. Thus, the bankruptcy probability expressions derived from the model of the firm developed in this thesis provide a guide for the conduct of empirical investigations of the probability of corporate failure.